PHASE TWO: BUILD UP
BUILDING BOUNDARIES

Mission: How can we build stronger boundaries between materials?

Age: 8+
Materials: $9

Time: 45 min
(Set-up: 5 min | Activity: 30 min | Clean-up: 10 min)

What you need:

Materials:
- Water
- Vegetable oil (about 1 cup)
- 1 tube gel food coloring (standard food coloring/egg dye will not work
- 16 oz. bottle corn syrup

Equipment:
- 3-5 small clear glasses (glass works better than plastic)
- 1-cup liquid measuring cup
- Spoon for mixing
- Data sheet
- (Optional) Ruler
- (Optional) Smartphone or camera for recording video

What to do:

Observing Boundaries

1. Prepare your glasses by rinsing them with water to wet the sides. This will help you build a smooth boundary without unwanted bubbles.

2. In your first glass, add about 1 inch of water (use a ruler if you like, but no need to be exact). Next, add a layer of oil above (a ~1/2 inch layer is plenty), pouring slowly down the side of the cup to help prevent those bubbles from forming. Look closely at where the oil and water meet - that's a boundary!

3. Hold the gel food coloring tube close to (but not touching) the surface of the oil, and very carefully release one drop near the center of the cup. Observe the boundary and the drop closely as it falls. What happens? Write your observations on the data sheet. Keep watching for 3-5 minutes to look for any changes over time. [Optional: Take a close-up picture of the drop at the boundary to compare later with other boundaries. Or record a time-lapse video to capture any interesting changes.]

4. In a second glass, add about one inch of corn syrup (we'll call this a 100% corn syrup solution). As before, add a layer of oil. Observe the boundary where the corn syrup and oil meet. Does it look any different from the water-oil boundary?

5. Repeat step 3, adding a drop to your second glass. Observe. What happens to the drop this time? Write your observations on the data sheet. Wait a while and see if anything changes.

6. Compare your two boundaries. Which do you think is stronger? Why?

Testing Boundaries

7. Prepare a 50% corn syrup solution (half water, half corn syrup): In your measuring cup, measure 1/2 cup corn syrup. Then add 1/2 cup water. Mix thoroughly with a spoon, until the liquid is clear and you can't see any more swirls of corn syrup.

8. In a third glass, build another boundary with your 50% corn syrup solution and oil above it. Based on your earlier observations, predict what will happen when you add a drop of food coloring. Record your prediction on the data sheet.

9. Test your prediction! Repeat step 3 to add a drop to your third glass. Was your prediction correct?

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10. Explore further! Try building boundaries with 25% corn syrup and 75% corn syrup solutions. Predict what will happen to the drop in each glass and test it out. Record your predictions and observations on the data sheet.

11. Experiment with building other boundaries too! Oil is the best choice for the upper liquid, but what variations could you try below? What other liquids might you try - maybe vinegar, or even egg whites? How about changing the temperature of the bottom liquid with warm or cold solutions? Every pair of liquids builds a different boundary!

Clean-up:

Dispose of all liquids down the drain with plenty of soap and water, and wash your dishes!

DATA SHEET

OBSERVING BOUNDARIES

What happens to the drop as it falls into the cup?
How does the drop behave at the boundary?
Does the drop's behavior, position, or shape change over time?

BOUNDARY	OBSERVATIONS
water — oil	
100% corn syrup — oil	
Which boundary do you think is stronger? Why?	

TESTING BOUNDARIES

BOUNDARY	Prepare corn syrup MIXTURE	Will the drop fall? (yes/no) PREDICT	Was your prediction correct? TEST
50% corn syrup — oil	1/2 cup corn syrup 1/2 cup water		
25% corn syrup — oil	1/4 cup corn syrup 3/4 cup water		
75% corn syrup — oil	3/4 cup corn syrup 1/4 cup water		